CLAIMS

What is claimed is:

1. An N×N circular-unimodal switch for serving a connection request to route k incoming signals, k≤N, and for enabling conditionally nonblocking switching, the circular-unimodal switch comprising

a switch means defined by a set of connection states and having an array of N input ports with N distinct input addresses and an array of N output ports with N distinct output addresses wherein the k incoming signals arrive at k distinct input ports determining k active input addresses and are destined for corresponding k distinct output ports determining k active output addresses, the switch means accommodating every complete matching between all input addresses and all output addresses subject to the constraint that, under the matching, the linear output address is a circular unimodal function of the linear input address, and

control circuitry, coupled to the switch means, for routing the incoming signals from the k distinct input ports to the corresponding k distinct output ports by activating one of the connection states such that the activated one of the connection states accommodates the connection request.

2. The circular-unimodal switch as recited in claim 1 wherein N=2 and the switch means is a switching cell.

3. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed by an N×N k-stage switching network composed of k stages of nodes, an interstage exchange between any succeeding two of the k stages, an input exchange and an output exchange, and wherein each node is filled with another switch means.

4. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed by an N×N k-stage switching network composed of k stages of nodes, an interstage exchange between any succeeding two of the k stages, an input exchange and an output exchange, and wherein each node is filled with another circular-unimodal switch.

5. The circular-unimodal switch as recited in claim 1 wherein k=2 and the switch means is constructed from a two-stage interconnection network composed of a first stage of nodes being the input nodes and a second stage of output nodes being the output nodes, an interstage exchange, and an output exchange corresponding to the interstage exchange appended to the network, and wherein each node is filled with another

circular-unimodal switch.

6. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed from a 2X interconnection network having nodes and wherein each node is filled with another circular-unimodal switch.

7. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed from a 2X interconnection network having nodes and wherein the nodes are filled with a plurality of other circular-unimodal switches.

8. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed from a recursive 2X interconnection network having nodes and wherein each node is filled with another circular-unimodal switch.

9. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed from a recursive 2X interconnection network having nodes and wherein the nodes are filled with a plurality of other circular-unimodal switches.

10. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed from a divide-and-conquer network appended with a SWAP exchange.

11. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed from a recursive 2X interconnection network having nodes and wherein each of the nodes is a cell and each cell is filled with a 2×2 circular-unimodal switch.

12. The circular-unimodal switch as recited in claim 11 wherein the 2×2 circular-unimodal switch is a switching cell.

13. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed from a recursive 2X interconnection network of cells with each cell filled with a 2×2 circular-unimodal switch.

14. The circular-unimodal switch as recited in claim 13 wherein the 2×2 circular-unimodal switch is a switching cell.

15. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed from a banyan-type network whose trace and guide are both monotonically decreasing and wherein each of the 2×2 nodes of the banyan-type network is filled with a 2×2 circular-unimodal switch.

16. The circular-unimodal switch as recited in claims from 15 wherein the 2×2 circular-unimodal switch is a switching cell.

17. The circular-unimodal switch as recited in claim 1 wherein the switch means is constructed from a recursive 2-stage interconnection network of cells appended with a SWAP exchange and wherein each cell of the network is a 2×2 circular-unimodal switch.

18. The circular-unimodal switch as recited in claim 17 wherein the 2×2 circular-unimodal switch is a switching cell.

19. A method for constructing an N×N circular-unimodal switch to serve a

connection request to route k incoming signals, k≤N, the method comprising

configuring a switch means defined by a set of connection states and having an array of N input ports with N distinct input addresses and an array of N output ports with N distinct output addresses wherein the k incoming signals arrive at k distinct input ports determining k active input addresses and are destined for corresponding k distinct output ports determining k active output addresses, the switch means accommodating every complete matching between all input addresses and all output addresses subject to the constraint that, under the matching, the linear output address is a circular unimodal function of the linear input address, and

routing the incoming signals from the k distinct input ports to the corresponding k distinct output ports by activating one of the connection states such that the activated one of the connection states accommodates the connection request.

20. The method as recited in claim 19 further including, prior to routing, activating one of the connection states in response to the connection request.

21. The method as recited in claim 19 further including, prior to activating, selecting one of the connection states in response to the connection request.